PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-122673
(43)Date of publication of application : 08.05.2001

(51)Int.CI. C04B 37/02
B23K 1/19
B23K 35/24
C09J 1/00
// B23K103:18

(21)Application number : 11-300184
(22)Date of filing : 21.10.1999

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(54) ADHESIVE COMPOSITION FOR JOINING DIFFERENT MEMBERS, JOINING METHOD USING THE SAME AND COMBINED MEMBER JOINED BY JOINING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an adhesive composition for joining two or more different members for obtaining a joined body excellent in heat-resistant characteristics or the like while restraining any damage of members to be joined by reducing the expansion coefficient, Young's modulus and yield strength value of the adhesive composition and to provide a joining method for joining two or more different members using the adhesive composition and a combined member consisting of two or more different members joined by the joining method.
SOLUTION: This adhesive composition comprises a mixture of at least two kinds of finely granulated materials different in wettability with a hard blazing filler metal and the blazing filler metal and is controlled in the expansion coefficient, Young's modulus and yield strength value. The manufacturing method of the joined body being the combined member excellent in heat-resistant characteristics or the like comprises joining different members to one another by using the adhesive composition after engaging with one another.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

(19)日本国特許庁(JP)　(12)公開特許公報（A）　(11)特許出願公開番号

特開２００１－１２２６７３
（Ｐ２００１－１２２６７３Ａ）
(43)公開日　平成13年5月8日(2001.5.8)

(51)Int.Cl.[7]	識別記号	FI		テーマコード(参考)
Ｃ０４Ｂ	37/02	Ｃ０４Ｂ	37/02	Ｂ 4G026
Ｂ２３Ｋ	1/19	Ｂ２３Ｋ	1/19	Ｚ 4J040
	35/24 ３１０		35/24 ３１０	
Ｃ０９Ｊ	1/00	Ｃ０９Ｊ	1/00	
// Ｂ２３Ｋ	103:18	Ｂ２３Ｋ	103:18	

審査請求　未請求　請求項の数１８　ＯＬ　（全１０頁）

(21)出願番号　特願平11-300184

(22)出願日　平成11年10月21日(1999.10.21)

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(54)【発明の名称】異種部材の接合用接着剤組成物、同組成物を用いた接合方法、および同接合方法により接合された複合部材

(57)【要約】
【課題】　膨張係数低減に加えて、ヤング率の低減、および耐力値の低減を行うことにより被接合体の破損を抑止しつつ耐熱特性等に優れた接合体を得ることのできる二種以上の異種部材の接合用接着剤組成物、同接着材を使用した二種以上の異種部材の接合方法、および同方法により接合された二種以上の異種部材からなる複合部材の提供。
【解決手段】　硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものと硬ろう材とからなる膨張係数、ヤング率、および耐力値が制御された接着剤組成物、同接着剤組成物を使用することにより、異種部材同士を嵌合構造を介して接合した異種部材同士からなる耐熱特性等に優れた複合部材の接合体の製造方法、および同方法により得られる異種部材同士からなる耐熱特性等に優れた複合部材の接合体により達成。

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【特許請求の範囲】

【請求項１】　硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものと硬ろう材とからなる二種以上の異種部材の接合用接着剤組成物。

【請求項２】　該硬ろう材のベース金属が、Ａｕ、Ａｇ、Ｃｕ、Ｐｄ、ＡｌまたはＮｉである硬ろう材であり、また該硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものが表面処理が施されていないセラミック微粒子、サーメット微粒子、または低膨張金属微粒子と、表面処理されているセラミック微粒子、サーメット微粒子、または低膨張金属微粒子との混合物であることを特徴とする請求項１に記載の接着剤組成物。

【請求項３】　該硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものが、表面処理が施されていない微粒子状の物質と、表面処理されている微粒子状の物質とが８０：２０～５：９５の混合比で含まれているものであることを特徴とする請求項２に記載の接着剤組成物。

【請求項４】　嵌合構造を構成する凹部を有する部材と、嵌合構造を構成する凸部を有する部材であって凹部を有する部材とは相異なる種類の部材とを、嵌合させ接合するに際して、

凹部を有する部材の凹部表面に、硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも２種混合したものを均一に敷き詰めた上で、該微粒子状の物質からなる層の少なくとも一部を被覆するように板状あるいは粉体状等の硬ろう材を配置し、更に凸部を有する部材を配置するか、

凹部を有する部材の凹部表面に、硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも２種混合したものを均一に敷き詰め、該硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも２種混合したものからなる層に密着するように、１または複数の穿孔された穴に硬ろう材が挿入された凸部を有する部材を配置するか、

あるいは、予め先端部に硬ろう材と硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものからなる層を形成した凸部を有する部材を用意しておき、凹部を有する部材の凹部表面に硬ろう材を配置した上に当該層を有する凸部を有する部材を配置する工程と、

かくして用意したものを加圧下で所定の温度に加温して、該硬ろう材を溶融して、硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものに含浸させて該硬ろう材と接合層を形成して、異種部材同士を嵌合構造を介して接合する工程からなる異種部材同士からなる複合部材を製造する方法。

【請求項５】　上記凸部を有する部材を配置する工程が凹部を有する部材の凹部表面に硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものを均一に敷き詰めた上で、該硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものからなる層の少なくとも一部を被覆するように板状あるいは粉体状等の硬ろう材を配置し、更に凸部を有する部材を配置することからなる請求項４に記載の方法。

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【請求項６】　上記凸部を有する部材を配置する工程が、凹部を有する部材の凹部表面に硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものを均一に敷き詰め、該硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものからなる層に密着するように、１または複数の穿孔された穴に硬ろう材が挿入された凸部を有する部材を配置する配置することからなる請求項４に記載の方法。

【請求項７】　上記凸部を有する部材を配置する工程が、予め先端部に硬ろう材と濡れ性において異なる微粒子状の物質を少なくとも二種混合したものからなる層を形成した凸部を有する部材を用意しておき、凹部を有する部材の凹部表面に硬ろう材を配置した上に当該層を有する凸部を有する部材を配置することからなる請求項４に記載の方法。

【請求項８】　該異種部材の少なくとも一方がセラミック製部材であることを特徴とする請求項４ないし７のいずれか１項に記載の方法。

【請求項９】　該異種部材の一方がセラミック製部材で、他方が金属製部材であることを特徴とする請求項４ないし８のいずれか１項に記載の方法。

【請求項１０】　該微粒子が熱応力を低下させる微粒子状の物質であることを特徴とする請求項４ないし９のいずれか１項に記載の方法。

【請求項１１】　該硬ろう材のベース金属が、Ａｕ、Ａｇ、Ｃｕ、Ｐｄ、ＡｌまたはＮｉである硬ろう材であり、該該硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも２種混合したものが表面処理が施されていないセラミック微粒子、サーメット微粒子、または低膨張金属微粒子と表面処理が施されているセラミック微粒子、サーメット微粒子、または低膨張金属微粒子との混合物であることを特徴とする請求項４ないし１０のいずれか１項に記載の方法。

【請求項１２】　該表面処理が施されているセラミック微粒子、サーメット微粒子、または低膨張金属微粒子が、メッキまたはスパッタにより金属で被覆された微粒子であることを特徴とする請求項４ないし１１のいずれか１項に記載の方法。

【請求項１３】　嵌合構造を構成する凹部を有する部材と、嵌合構造を構成する凸部を有する部材であって凹部を有する部材に対して異種の部材とからなり、上記異種部材は相互に嵌合され、硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものと硬ろう材からなる接合層により接合されている複合部材。

【請求項１４】　該二種以上の異種部材の少なくとも一つがセラミック製部材である請求項１３に記載の複合部材。

【請求項１５】　該二種以上の異種部材が金属製部材とセラミック製部材との組み合わせである請求項１３または１４に記載の複合部材。

【請求項１６】　該微粒子が熱応力を低下させる微粒子状の物質であることを特徴とする請求項１５に記載の複合部材。

【請求項１７】　該硬ろう材のベース金属が、Ａｕ、Ａｇ、Ｃｕ、Ｐｄ、ＡｌまたはＮｉである硬ろう材であり、該硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものが表面処理が施されていないセラミック微粒子、サーメット微粒子、または低膨張金属微粒子と、表面処理されているセラミック微粒子、サーメット微粒子、または低膨張金属微粒子との混合物であることを特徴とする請求項１３ないし１６のいずれか１項に記載の複合部材。

【請求項１８】　該表面処理されているセラミック微粒子、サーメット微粒子、または低膨張金属微粒子が、メッキまたはスパッタにより金属で被覆された微粒子であることを特徴とする請求項１３ないし１７のいずれか１項に記載の複合部材。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】　本発明は、嵌合構造を介して接合された二種以上からなる異種部材の接合用接着剤組成物、同組成物を用いた接合方法、および同接合方法により接合された複合部材に関する。更に詳しくは、異なる二種以上の部材からなる複合部材の接合用接着剤組成物であって、異種部材同士を嵌合構造を介して接合するための膨張係数および残留応力が制御された接着剤組成物、同組成物を用いた二種以上の異種部材同士を接合する方法、および同方法により接合された複合部材に関する。

【０００２】

【従来の技術】　異種部材の接合、例えば、セラミック製部材と金属製部材との接合には、ろう材を用いる方法があるが、高温での接合後の冷却操作中に、異種部材間、あるいはこれら異種部材を接合するために使用したろう材と部材との熱膨張率の差に起因する熱応力が発生し、接合界面に剥離を生じたり、また、一方の部材が脆弱な場合には、接合界面近傍にクラックを生じたりして、所望の接合強度や気密性を得られないことがある。製造過程でこれらの異常が発生した製品は、不良品として処分せざるを得ないためにこれら複合部材の製品のコストを押し上げる一因となっている。また、使用時に熱サイクルがかかる場合には、これらの異常が一定期間の使用後に発生して、製品の信頼性を低下させる一因ともなっている。

【０００３】　異種部材をろう材を用いて接合[redacted]には、セラミック製部材とろう材との濡れを確保[redacted]めにセラミック製部材の接合面の表面を金属、例えば[redacted]Ｎｉ等の金属でメッキした後、両部材を適当な間隔をおいて向かい合わせて配置させ、この間隔にろう材を流し込み、接合させる方法が通常採用されている。また、金属メッキ処理がなくてもセラミック表面に窒化物、酸化物等の反応層を形成することで濡れを確保することができるＴｉ等の添加物をろう材中に加える手法もある。しかしながらこれらの方法では、熱応力を低下させるのには、充分でなく、熱応力に対して脆弱なセラミック製部材側にしばしばクラックが形成されたり、接合部に剥離を生じたりして、結合強度ばかりでなく複合部材として要求される気密性などの各種性能に影響を及ぼすので好ましくない。また、熱応力を緩和する方法としては、接合の際に熱膨張率の低い金属を中間材として使用する方法、セラミックとの反応性に富み、塑性変形することにより応力を緩和することのできる軟質金属を中間材として使用する方法が通常採用されている。しかし、これらの技術も、ろう材と部材間の熱膨張差に起因する問題、例えば熱サイクル特性の低さ等が問題とされており、必ずしも汎用性の高い技術とは言えない。また、現在開発中の技術として高圧固相接合法があるが、実用化するには未解決の課題があり、従って、この方法では充分な結合強度がでていないのが現状である。

【０００４】　一方、複合半田としては、半導体チップと基板との固着に使用するものであって、半田よりも融点の高い材質からなる粉末体を混合したものが特開平６－１２６４７９号公報に開示されているが、この複合半田は、半田本体の中央部にのみ半田よりも融点の高い材質からなる粉末体を充填させることにより、従来の複合半田が有している表面にも存在している粉末体に起因する半田濡れ不良を解消すること、換言すれば、接合界面での接合強度を増加させることを目的とするものであるが、しかし、この複合半田は、熱応力の低下には有効ではなく、従って、接合される部材間あるいは部材とろう材間の熱応力に起因する問題を解決するのには有効ではない。

【０００５】　本発明者等は、上記の目的を達成するために種々検討の結果、異種部材同士を適度な結合強度を保持しながら、高温での接合後における冷却操作の間の熱応力による接合界面近傍での接合強度の低下現象や、熱応力に対して弱い部材での冷却操作中にクラックを発生させない、二種以上の異種部材間の接合用接着剤組成物を見出した。その具体的な内容については、平成１０年２月１８日に特願平１０－５２９７１号として出願している。

【０００６】　即ち、上記の様な現状に鑑みて種々検討した結果、接合部材の種類や形状等による制約が少なく、接合形状も選択の余地の多い硬ろう材をベースとし

て用いること、この硬ろう材に熱応力を低下させる微粒子状の物質を添加することにより、異種部材同士を適度な結合強度を保持しながら、高温での接合後における冷却操作の間の熱応力による接合界面近傍での接合強度の低下現象も起こさず、また、熱応力に対して弱い部材での冷却操作中にクラック発生させず、二種以上の異種部材間の接合を達成できることを見いだし、上記特許出願に至ったものである。

【０００７】　上記の組成物を使用して接合する方法として、相互にその熱応力を異にする二種以上の異種部材同士を接合させるのに充分な間隔を置いて互いに向かい合わせに配置させ、該間隔に上記組成物を流し込むか、所定量のセラミックまたはサーメット微粒子を充填し、引き続いて溶融状態にした所定量の硬ろう材を流し込み、ついで冷却して該二種以上の異種部材同士を接合させて複合部材を製造する方法を上記特許出願において開示しているが、所定量の硬ろう材を流し込み得るだけの充分な間隔を有しない部材同士の接合には、そのままでは、使用できない。

【０００８】　嵌合構造を介して接合しなければならない二種以上からなる異種部材を接合する場合、特に、クリアランスとして、０．０１～０．３０ｍｍ程度の極めて狭いものを選択し、両部材を接合しようとしたときには、部材の側面にも極力全般的に均等にろう材を充填しないと、種々の不都合が生じることが少なくない。一方、該クリアランスが上記の上限よりも大きい場合には、ろう材の溶融時に、ろう材が該クリアランスに均等に充填されないことにより発生する内包された残留応力により、クラックが発生することがある。これをより具体的に説明すると、例えば、円柱状の凹部を有する部材と円柱状の凸部を有する部材を嵌合する際に、両部材から形成される円柱状のクリアランスに均等に充填されるべきろう材が、該クリアランスがある程度の余裕があるために、何かの原因で一方のみに片寄ってしまうと、ろう材を冷却、凝固させる過程での熱収縮応力のバランスが崩れて、円柱状の凸部を有する部材が一方向に引っ張られ、その結果残留応力が生じて、クラックを発生させてしまうことがある。さらに、完成品としての複合部材の寸法精度上の要請や美観上の要請もある。従って、このように上記のような狭いクリアランスしかない部材同士に、この狭いクリアランスから所定量の硬ろう材を流し込みことは実質的に不可能であるので、該異種部材同士を上記方法により接合することはできなかった。なお、ここでクリアランスとは、嵌合構造部分における該異種部材同士の壁面間に存在する隙間の幅をいう。

【０００９】　そこで、本発明者等はかかる課題を解決するために、嵌合構造を構成する凹部を有する部材と、嵌合構造を構成する凸部を有する部材であって凹部を有する部材とは相異なる種類の部材とを、嵌合させ接合するに際して、凹部を有する部材の凹部表面に微粒子状の物質を均一に敷き詰めた上で、該微粒子状の物質からなる層の少なくとも一部を被覆するように板状あるいは粉体状等の硬ろう材を配置し、更に凸部を有する部材を配置して、加圧下で所定の温度に加温して硬ろう材を溶融し、この溶融した硬ろう材を該微粒子状の物質からなる層中に浸透させ、該硬ろう材と微粒子状の物質からなる膨張係数が制御された接着剤組成物による接合層を形成するか、嵌合構造を構成する凹部を有する部材と、嵌合構造を構成する凸部を有する部材であって凹部を有する部材とは相異なる種類の部材とを嵌合させ接合するに際して、凹部を有する部材の凹部表面に微粒子状の物質を均一に敷き詰め、該微粒子状の物質からなる層に密着するように、１または複数の穿孔された穴に硬ろう材が挿入された凸部を有する部材を配置し、加圧下で所定の温度に加温して硬ろう材を溶融し、この溶融した硬ろう材を該微粒子状の物質からなる層中に浸透させ、該硬ろう材と微粒子状の物質からなる膨張係数が制御された接着剤組成物による接合層を形成するか、予め先端部に硬ろう材と微粒子状の物質からなる層を形成した凸部を有する部材を用意しておき、凹部を有する部材の凹部表面に硬ろう材のみを配置した上に、当該硬ろう材と微粒子状の物質からなる層が形成された凸部を有する部材を配置し、加圧下で所定の温度に加温して、該凸部を有する部材の先端に形成された硬ろう材と微粒子状の物質からなる層と、凹部を有する部材の凹部表面に配置した硬ろう材とを溶融し、硬ろう材と微粒子状の物質からなる膨張係数が制御された接着剤組成物からなる接合層を形成することにより、異種部材同士を嵌合構造を介して接合できることを見出して、その知見に基づき平成１１年６月２５日に特願平１１－１８０９０２号として出願している。

【００１０】　また、平成１１年６月２５日に出願した特願平１１－１８０９０２号明細書においては、かくして嵌合され接合された、嵌合構造を構成する凹部を有する部材と、嵌合構造を構成する凸部を有する部材であって凹部を有する部材とは相異なる種類の部材とから少なくともなり、上記異種部材同士は相互に嵌合され、微粒子状の物質と硬ろう材からなる膨張係数が制御された接着剤組成物により接合されていることを特徴とする二種以上の異種部材からなる改良された熱サイクル特性を有する複合部材についても、同時に提案している。

【００１１】　しかしながら、硬ろう材中に分散させる分散材には、硬ろう材との濡れを確保するためにＮｉメッキが施される。この手法で形成される複合体たるろう材層は、金属材料たる硬ろう材に比して膨張係数が低減され被接合体たるセラミック等の破損抑止や接合部の熱サイクル特性改善に有効であるが、被接合体たるセラミックの強度が低い場合、例えば、窒化アルミニウム等の場合、破損を完全に抑制することが困難であり、被接合部面積が大きくなればさらにその破損発生の危険性は多

くなり、また一製品内の接合部位数が多い場合には製品の不良率が無視し難いという問題に遭遇した。被接合体の破損抑止にはろう材の膨張係数低減のほかに、ヤング率の低減、耐力値の低減等が有効であるが、上記の手法のみによっては、これらの物理特性全てを積極的に有利に操作することは困難であることが判明した。

【００１２】

【発明が解決しようとする課題】　従って、本発明が解決しようとする課題は、上記の複合ろう材の特性制御、すなわち膨張係数低減に加えて、ヤング率の低減、および耐力値の低減を行うことにより被接合体の破損を抑止しつつ耐熱特性等に優れた接合体を得ることのできる二種以上の異種部材の接合用接着剤組成物、同接着材を使用した二種以上の異種部材の接合方法、および同方法により接合された二種以上の異種部材からなる複合部材を提供することにある。

【００１３】

【課題を解決するための手段】　本発明者等は、上記の課題を解決するために、種々検討の結果、硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものと硬ろう材とからなる二種以上の異種部材の接合用接着剤組成物が上記の目的を達成できることを見いだして本願発明を完成させたものである。

【００１４】　また、上記の手法により膨張係数、ヤング率、および耐力値が制御された接着剤組成物を使用することにより、破損が抑止され耐熱特性等に優れた異種部材同士を嵌合構造を介して接合した異種部材同士からなる複合部材の接合体を製造することができることを見いだして、本発明の第２の側面を完成させたものである。更に、上記の膨張係数、ヤング率、および耐力値が制御された接着剤組成物を使用することにより、嵌合構造を構成する凹部を有する部材と、嵌合構造を構成する凸部を有する部材であって凹部を有する部材に対して異種の部材とからなり、上記異種部材は相互に嵌合され、硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものと硬ろう材からなる接合層により接合されている耐熱特性等に優れた複合部材が、破損を生起することなく得られることを見いだして、本発明の第３の側面を完成させたものである。

【００１５】

【発明の実施の形態】　本発明の第１の側面は、硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものと硬ろう材とからなる二種以上の異種部材の接合用接着剤組成物に関する。この接着材組成物においては、硬ろう材を構成するベース金属は、Ａｕ、Ａｇ、Ｃｕ、Ｐｄ、ＡｌまたはＮｉであり、また該硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものとしては、表面処理が施されていないセラミック微粒子、サーメット微粒子、または低膨張金属微粒子と、表面処理が施されているセラミック微粒子、サーメット微粒子、または低膨張金属微粒子との混合物であることが好ましい。硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものとしては、表面処理が施されていない微粒子状の物質と、表面処理されている微粒子状の物質の混合比が５：９５～８０：２０であるものが好ましい。硬ろう材との濡れ性において異なる物質とは、硬ろう材との相対的な濡れ性において、より優れているものと、より劣っているものとの組み合わせをいう。

【００１６】　硬ろう材との相対的な濡れ性において、より優れているものと、より劣っているものとの組合わせの例としては、メッキ等の表面処理を施したセラミック微粒子と表面処理が施されていないセラミック微粒子、メッキ等の表面処理を施したあるいは施されていない低膨張金属微粒子と表面処理が施されていないセラミック微粒子等がある。これらにおけるメッキ方法としては特に制限はないが、無電解メッキが好適に使用される。また、金属メッキ処理がなくても、Ｔｉ等の添加物をろう材、もしくは、微粒子状物質中に微粒子として混合することで、セラミック表面に窒化物、酸化物、炭化物等の活性材の反応層を形成することで硬ろうとの濡れを確保することができる。この際に該添加物を含む硬ろう材との濡れ性に差異のあるものを組みあわせれば、前記の効果を奏することが可能である。例えば分散材の組合わせを窒化物と酸化物、あるいは窒化物と炭化物とすることで好適にその効果を得る事ができる。これら場合における該活性材の添加量は、硬ろう材に対し、重量比で０．５～５％程度が好適である。すなわち、硬ろう材との濡れ性において異なる物質を少なくとも２種混合したものからなる微粒子状の物質は、例えば、所望の厚さに表面処理が施された粒子として０．５μｍ程度のＮｉメッキが施された、所望の粒度、例えば、平均粒径５０μｍのアルミナ粒子と、表面処理が施されていない粒子として、所望の粒度、例えば、平均粒径５０μｍのアルミナ粒子を混合することにより容易に調製することができる。あるいは添加材たるTi等を一定量含む硬ろう材との濡れ性において異なる物質を少なくとも２種混合したものからなる微粒子状の物質は、例えば、所望の粒度、例えば、平均粒径５０μｍの窒化アルミと、所望の粒度、例えば、平均粒径５０μｍのアルミナ粒子を混合することにより容易に調製することができる。

【００１７】　表面処理が施されていない微粒子状の物質と、表面処理されている微粒子状の物質の混合比は、より好ましくは１：９、すなわち表面処理が施されていない微粒子状の物質が全粒子中に占める比が１０％程度から３：１、即ち、７５％程度であり、更に好ましくは、１：３から１：１程度である。３：１より非表面処理材の混合比を上げると接着剤としての作用効果が著しく低下するので好ましくない。本発明に係る接着剤組成物を得る上で、浸透させる硬ろう材、浸透させる方法、

条件等は特願平１１－１８０９０２号明細書の記載に従えば良い。また濡れ性を確保する表面処理が施されている微粒子状の物質と、濡れ性を確保する表面処理が施されていない微粒子状の物質は、必ずしも同一種の物質でなくともよく、濡れ性を確保するために、表面処理が施されている微粒子状の物質と表面処理が施されていない微粒子状の物質との組み合わせであればよい。還元すれば、メッキ処理の有無のみが異なる同一種を用いなくてもよいことはいうまでもない。

【００１８】　本発明に係る接着物組成物に使用する硬ろう材としては、Ａｕ、Ａｇ、Ｃｕ、Ｐｄ、Ａｌ、Ｎｉ等の金属をベースとしたろう材が挙げられる。勿論、接合する部材とろう材との濡れ性、あるいは接合する部材もしくは分散粒子とろう材との反応性、あるいはろう材が使用される温度条件等との関係で、より適切なものを使用すればよい。接合部材の使用環境温度が５００℃以下のものとしては、Ａｌ系ろう材、例えば、ＢＡ４００４（Ａｌ－１０Ｓｉ－１．５Ｍｇ）等が好適に使用される。接合部材の使用環境温度が５００℃以上のものとしては、Ａｕ、ＢＡｕ－４（Ａｕ－１８Ｎｉ）、ＢＡｇ－８（Ａｇ－２８Ｃｕ）等が好適に使用される。

【００１９】　本発明に係る接着剤組成物を使用することにより、硬ろう材中に分散させる分散材と硬ろう材との界面接合力を積極的に一部低減させるか、あるいは接着剤組成物中に積極的に微細な空孔を形成させることにより、膨張係数低減に加えて、ヤング率の低減、および耐力値の低減を行うことにより被接合体の破損を抑止しつつ耐熱特性等に優れた接合体を得ることができるという効果が発揮されることとなる。より具体的には、硬ろう材中に分散させる分散材を、硬ろう材との濡れ性に優れた粒子と、濡れ性に劣った粒子を混合して用いることで、この効果は達成される。ここに硬ろう材との濡れ性に優れた粒子と濡れ性に劣った粒子の組合わせとしては、硬ろう材との濡れ性を確保できるメッキ処理等の表面処理がされた粒子とメッキ処理等の濡れ性を確保する表面処理が施されていない粒子、あるいは窒化物と酸化物、低膨張金属粒子と酸化物等が好適に利用される。硬ろう材との濡れ性に優れた粒子の比率が多い場合には、光学的に観察される接着剤組成物のミクロ組織の構造上は、表面処理が施された粒子のみでつくられた接着剤組成物と差はないが、濡れ性に優れた粒子のみでつくられた接着剤組成物と同等の膨張係数低減、ヤング率低減が達成されているだけでなく、耐力値の低減効果は、表面処理が施された粒子のみでつくられた接着剤組成物よりも高い。これは、濡れ性に劣った粒子と硬ろう材との界面接合力が、濡れ性に優れた粒子に比して低減されることで、接着剤組成物の特性が制御されたものと考えられる。

【００２０】　また、硬ろう材との濡れ性が劣った粒子の比率をあげていくと、接着剤組成物中には光学的に観察可能な空孔が形成され、濡れ性が優れた粒子のみでつくられた接着剤組成物と同等の膨張係数低減に加えて、硬ろう材との濡れ性が劣った粒子の量がより少ない組成物に比較して、よりヤング率の低減、および耐力値の低減が達成される。これは、硬ろう材との濡れ性が劣った粒子がより多い組成物においたは、分散材と硬ろう材との界面接合力の低減効果に加えて、形成された空孔の存在により当該組成物のみかけの断面積が減少する結果、ヤング率が低減し、また当該空孔部位近傍等が負荷時の亀裂生起点となることで耐力が低減するものと理解される。本発明に係る接着剤組成物が奏する効果を発現させる機構を説明する上で、メッキ処理等の濡れ性を確保する表面処理が施されていない粒子の多寡で、その作用効果を便宜上分けて説明したが、その目的、作成手法、作用効果は同一であり、境界を厳密に分ける必要性は低い。ただし、当該接着剤組成物の接合部のシール性を考える上では、必要となる場合がある。

【００２１】　熱応力を効率的に低下させるためには、微粒子状の物質の種類ならびに硬ろう材に対するその充填密度を調整することが必要となり，そのためには，接着剤組成物層の熱膨張係数を調整することが必要となる。熱応力を低下させる微粒子状の物質は、その膨張係数が小さいほど接着剤組成物層の熱膨張係数を下げるのには有利である。微粒子状の物質の硬ろう材に対する充填密度は、硬ろう材との濡れ性に優れた粒子のみ分散させる場合で、体積比で３０から９０％、望ましくは４０から７０％となる様にする。硬ろう材との濡れ性に優れた粒子のと硬ろう材との濡れ性に劣った粒子を分散させる場合で、該接着剤組成物中に空孔がないものとして算定した場合の粒子の体積比が前記と同様に３０から９０％、望ましくは４０から７０％となる様にする。またこれらの際、微粒子状の物質の充填密度を上げることは、膨張係数を下げるには有利であるが、あまり充填密度を高くすることは、接合強度の劣化を伴う場合があるので好ましくない。また、低い場合は、所望とする膨張係数に達しない場合があるので留意が必要である。すなわち、膨張係数の調整は、微粒子状の物質の種類を所望の膨張係数が達成できるように選択するか、微粒子状の物質の粒度分布を適宜選択することで達成される。

【００２２】　本発明の第２の側面は、嵌合構造を構成する凹部を有する部材と、嵌合構造を構成する凸部を有する部材であって凹部を有する部材とは相異なる種類の部材とを、嵌合させ接合するに際して、凹部を有する部材の凹部表面に、硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものを均一に敷き詰めた上で、該硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものからなる層の少なくとも一部を被覆するように板状あるいは粉体状等の硬ろう材を配置し、更に凸部を有する部材を配置するか、凹部を有する部材の凹部表面に、硬ろう材との濡

れ性において異なる微粒子状の物質を少なくとも二種混合したものを均一に敷き詰め、該微粒子状の物質からなる層に密着するように、１または複数の穿孔された穴に硬ろう材が挿入された凸部を有する部材を配置するか、あるいは、予め先端部に硬ろう材と硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものからなる層を形成した凸部を有する部材を用意しておき、凹部を有する部材の凹部表面に硬ろう材を配置した上に当該層を有する凸部を有する部材を配置する工程と、かくして用意したものを加圧下で所定の温度に加温して、該硬ろう材を溶融して、硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものに含浸させて該硬ろう材と該微粒子状の物質とからなる接合層を形成して、異種部材同士を嵌合構造を介して接合する工程からなる異種部材同士からなる複合部材を製造する方法に関する。

【００２３】　本発明の第２の側面に係る接合方法の第１の態様は、凹部を有する部材（１）の凹部表面に硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したもの（４）を均一に敷き詰めた上で、該硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものからなる層の少なくとも一部を被覆するように板状あるいは粉体状等の硬ろう材（３）を配置し、更に凸部を有する部材（２）を配置し、加圧下で所定の温度に加温して硬ろう材を溶融させ、溶融させた硬ろう材を該微粒子状の物質に浸透させて、該硬ろう材と微粒子状の物質からなる接着組成物による接合層を形成することで異種部材同士を嵌合構造を介して接合する方法である。この際、該微粒子状の物質と粉体状の硬ろう材を混合したものを、該微粒子状の物質からなる層および同層を被覆する板状あるいは粉体状の硬ろう材の代わりに使用してもよい。また、第２の態様は、凹部を有する部材（１）の凹部表面に硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したもの（４）を均一に敷き詰め、該微粒子状の物質からなる層に密着するように、１または複数の穿孔された穴に硬ろう材（３）が挿入された凸部を有する部材（２）を配置して、加圧下で所定の温度に加温して硬ろう材を溶融させ、溶融させた硬ろう材を該硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものに浸透させることによって、該硬ろう材と微粒子状の物質からなる接着組成物による接合層を形成することで異種部材同士を嵌合構造を介して接合する方法である。また、第３の態様は、予め先端部に硬ろう材と硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものからなる層（５）を形成した凸部を有する部材（２）を用意しておき、凹部を有する部材（１）の凹部表面に硬ろう材（６）を配置した上に当該層を有する凸部を有する部材を配置して、加圧下で所定の温度に加温し、該凸部を有する部材の先端に形成された硬ろう材と硬ろう材との濡れ性において異なる微粒子状の物質を少なくとも二種混合したものからなる層と、凹部を有する部材の凹部表面に配置した硬ろう材とを溶融し、硬ろう材と微粒子状の物質からなる接合層を形成することにより異種部材同士を嵌合構造を介して接合する方法である。

【００２４】　なお、上記以外に接合に際して採用される条件、例えば、各種材料の配置方法、溶融温度等を含む溶融条件、冷却条件等は、平成１０年２月１８日の出願に係る特願平１０－５２９７１号および平成１１年６月２５日に出願した特願平１１－１８０９０２号明細書に記載に従えばよい。従って、平成１０年２月１８日の出願に係る特願平１０－５２９７１号および平成１１年６月２５日に出願した特願平１１－１８０９０２号明細書の内容を参考までにここに引用する。

【００２５】　本発明において使用する二種以上の異種部材の組合わせとしては、例えば窒化アルミニウムや窒化珪素等のセラミックス製部材と、モリブデンやコバール、タングステン等の金属部材との組み合わせ、あるいは、製造原料をことにする等の異種セラミック製部材同士の組合わせが挙げられる。より具体的には半導体ウエハー製造において使用される、内蔵する金属電極や金属発熱体によって静電チャック機能やヒーター機能を発揮する窒化アルミニウム部材と、当該内蔵される金属電極材等へ給電を行う端子として接合される例えば金属モリブデン部材とを嵌合させ接合することからなる複合部材等が挙げられる。

【００２６】　本発明の第３の側面である、嵌合構造を構成する凹部を有する部材と、嵌合構造を構成する凸部を有する部材であって凹部を有する部材とは相異なる種類の部材とからなり、上記異種部材は相互に嵌合され、基本的には、硬ろう材との濡れ性において異なる物質を少なくとも２種混合したものからなる微粒子状の物質と硬ろう材からなる接着剤組成物からなる接合層により接合されている、二種以上の異種部材からなる複合部材は、上記の方法により製造可能である。凹部を有する部材の壁面と、同凹部を有する部材とは相異なる種類の部材からなる凸部を有する部材との壁面との間に形成される、嵌合構造部における異種部材の壁面間のクリアランスは、通常、０．０１～０．３ｍｍ程度、好ましくは、０．０２～０．０７ｍｍ程度とするとよい。上記下限を逸脱すると、部材同士を嵌合することができない恐れがあり、また、上記上限を逸脱すると、上述した様にろう材が偏って充填されたりする不都合が生ずる恐れがあり好ましくない。

【００２７】

【実施例】　以下実施例を挙げて、本発明を説明するが、勿論、本発明は、これらの例により何等制限されるものではないことはいうまでもない。接合状態ならびに耐熱サイクル特性の評価は、耐熱サイクル雰囲気に曝露

した前後の、接合部の引張り強度の劣化が起こっているか否かによって判定した。この際、曝露前に対して２５％以上の強度劣化を引き起こしたものは不良と判断した。また参考のため、接合層断面観察により接合部に基材割れや剥離が生じていないか否かも調査した。

【００２８】　（実施例１）粒子表面に厚さ約０．３μｍのＮｉメッキ処理を施した平均粒径５０μｍのアルミナと、表面処理を施さない平均粒径５０μｍのアルミナをそれぞれ、１：０、３：１、２：１、１．５：１、１：１、１：３の比率で混合したものを分散粒子とし＊て、当該分散粒子に一定加圧下で硬ろう材Ａ５００５（Ａｌ－０．８Ｍｇ）を浸透させたのち、凝固させた接着剤組成物から調製したサンプルで計測した機械物理特性を表１に示す。またそのうちの代表的なもののミクロ組織の光学顕微鏡写真を図２ないし４に示す。なお、図１は比較例であるＮｉメッキ処理を施した平均粒径５０μｍのアルミナのみからなる微粒子状の物質を使用したもののミクロ組織を示す光学顕微鏡写真である。

【００２９】

【表１】

接着剤組成物の機械物理特性

ﾒｯｷ厚さ（μｍ）	ﾒｯｷ処理粒の混合率(%)	膨張係数（×10⁻⁶）	ﾔﾝｸﾞ率 (GPa)	比例限 (MPa)	備考
0.3	１００	１３．４	１０３	７０	
0.3	７５	１３．５	１０１	６５	
0.3	６７	１３．２	９５	６３	
0.3	６０	１３．１	７５	５２	
0.3	５０	１３．５	５７	４５	
0.3	２５	－	－	－	安定接合に難あり

【００３０】　（実施例２）粒子表面に約１μｍのＮｉメッキ処理を施した平均粒径５０μｍのアルミナと、表面処理を施さない平均粒径５０μｍのアルミナをそれぞれ、１：０、３：１、２：１、１．５：１、１：１、１：３の比率で混合したものを分散粒子として、当該分散粒子に一定加圧下で硬ろう材Ａ５００５（Ａｌ－０．※８Ｍｇ）を浸透させたのち凝固させた接着剤組成物から調製したサンプルで計測した機械物理特性を表２に示す。

【００３１】

【表２】

接着剤組成物の機械物理特性

ﾒｯｷ厚さ（μｍ）	ﾒｯｷ処理粒の混合率（%）	膨張係数（×10⁻⁶）	ヤング率（ＧＰａ）	比例限（ＭＰａ）	備考
1.0	１００	１３．１	１３５	１０３	
1.0	７５	１３．５	１２９	９１	
1.0	６７	１２．８	１０２	８３	
1.0	６０	１３．３	９０	６２	
1.0	５０	１２．２	７０	４７	
1.0	２５	１３．０	５９	２５	

【００３２】　（実施例３）嵌合構造を構成する凹部を有する部材として、部材の厚さが１０．０ｍｍ、部材に垂直に穿孔された勘合用の切り込み構造部の穴の直径が５．０７ｍｍ、その深さが９．５ｍｍの窒化アルミニウム部材と、嵌合構造を構成する凸部を有する部材であって、凹部を有する部材とは相異なる種類の部材として直径５．０ｍｍ、長さ１５．０ｍｍの円柱状の金属モリブデン製部材を使用して以下の条件で接合した。

【００３３】　凹部を有する部材である窒化アルミニウム製部材の約０．５μｍのＮｉメッキ処理が施された凹部表面に、粒子表面に厚さ約０．３μｍのＮｉメッキ処理を施した平均粒径５０μｍのアルミナと、表面処理を施さない平均粒径５０μｍのアルミナをそれぞれ、１：０、２：１、１：１の比率で混合したものを分散粒子としてそれぞれ均一に敷き詰めた。当該敷き詰められた分散粒子の層の厚さは、それぞれ０．８ｍｍであった。該分散粒子を覆うように配置された硬ろう材Ａ５００５（Ａｌ－０．８Ｍｇ）は加熱中に溶融し微粒子状の物質からなる層中に浸透し、複合接着層を形成した。かくして、少なくとも硬ろう材との濡れ性において異なる微粒子状の物質を２種以上混合したものと硬ろう材からなる複合接着層で接合された試料を２種類と、比較例としてＮｉメッキ処理を施した平均粒径５０μｍのアルミナのみからなる微粒子状の物質と硬ろう材からなる、複合接着層で接合された試料を１種類調製した。形成された複合接着層の厚さはそれぞれ０．８ｍｍであった。

【００３４】　こうして得られた接合部材を熱サイクル試験に供した。熱サイクル試験条件は、同接合部材を昇温速度２．５℃／ｍｉｎで６０℃から１８０℃へ昇温し、１８０℃へ到達後直ちに降温速度－２．５℃／ｍｉ

ｎで６０℃へ降温し、６０℃へ到達後、直ちに再び同一のサイクルを繰り返すという処理を５０回にわたって繰り返した。熱サイクル試験後の窒化アルミの割れ発生状況を表３に示す。また熱サイクル試験前後のモリブデン端子と窒化アルミの接合強度試験結果を表４に示す。

【００３５】

【表３】

被接合体の破損抑止効果

ﾒｯｷ処理粒の混合率（%）	膨張係数（×10⁻⁶）	ﾔﾝｸﾞ率（ＧＰａ）	比例限（ＭＰａ）	破損抑止効果（破損数／サンプル数）
１００	１３．１	１３５	１０３	４／１８
６７	１２．８	１０２	８３	１／１９
５０	１２．２	７０	４７	０／３５

【００３６】

【表４】

被接合体の接合強度

実施例、比較例の別	ﾒｯｷ処理粒の混合率（%）	接合上がり強度（MPa）	熱ｻｲｸﾙ試験後の強度（MPa）	熱ｻｲｸﾙ試験前後の強度の比（%）
比較例　１	１００	４７２３	４９６９	１０３
比較例　２	１００	５０６９	４７９４	１００
比較例　３	１００	４６３９	４５４９	９５
実施例１－１	６７	４７６８	４４９０	９４
実施例１－２	６７	４３３０	４９３０	１０１
実施例１－３	６７	４５３０	４７５０	１００
実施例２－１	５０	４９３０	４３８０	９２
実施例２－２	５０	４９４４	５１２０	１１０
実施例２－３	５０	４７３０	４５３０	９７

＊　熱サイクル試験前後の強度の比（%）は比較例、実施例１、実施例２とも接合上がり強度（ＭＰａ）（ｎ＝８）の平均値に対する熱サイクル試験後の強度（ＭＰａ）として示した。

【００３７】　上記の表１に示した試験結果、および図２ないし４として添付したミクロ構造の顕微鏡写真から明らかなように、本発明に係る接合用接着剤組成物は、分散材と硬ろう材との接合力が一部制御されあるいはミクロ組織中に微細な空孔が導入されるため、該接合力の制御された部位か、あるいは、該導入された空孔が破壊起点として働く結果、熱応力等力が加わった際にも上記表３に示す如く破損を効果的に回避できる。なお、表１に示したように、本発明に係る接合用接着剤組成物の場合には、ヤング率の低減、耐力値の低減は認められるものの熱膨張率は、メッキ処理を施した微粒子状の物質のみを使用したものと実質的に差異がないことで、表４に示す通り接合体の接合上がりの強度ならびに耐熱性に差異はないことは注目すべき点である。

【００３８】

【発明の効果】　本願発明に係る接合用接着剤組成物を使用することにより、窒化アルミニウム等の様に被接合体たるセラミックの強度が低い場合でも、上記の複合ろう材の特性制御、すなわち膨張係数低減に加えて、ヤング率の低減、耐力値の低減を行うことにより、被接合体の破損を抑止しつつ耐熱特性等に優れた接合体を得ることができる。また、この様な本願発明に係る接合用接着剤組成物を使用した接合方法によれば、接着される部材間に残留する応力を低減させることで当該部材に発生しうる破損ないし接合不具合を回避させることができ、信頼性の高い異種部材同士からなる複合部材を製造することができる。かくして信頼性の高い異種部材同士からなる複合部材が提供できるという効果を発揮するものである。

【図面の簡単な説明】

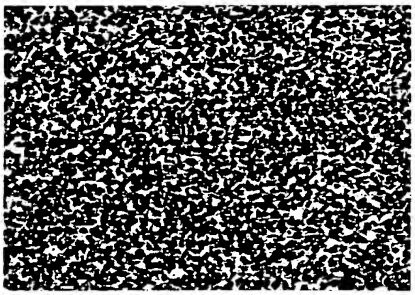
【図１】　メッキ処理を施した微粒子状の物質のみを使用した接着剤のミクロ組織を示す光学顕微鏡写真である。

【図２】　メッキ処理を施してない微粒子状の物質とメッキ処理を施した微粒子状の物質を１：３の割合で使用した接着剤のミクロ組織を示す光学顕微鏡写真である。

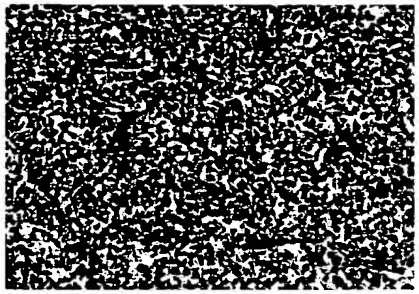
【図３】　メッキ処理を施してない微粒子状の物質とメッキ処理を施した微粒子状の物質を１：２の割合で使用した接着剤のミクロ組織を示す光学顕微鏡写真である。

【図４】　メッキ処理を施してない微粒子状の物質とメッキ処理を施した微粒子状の物質を１：１の割合で使用した接着剤のミクロ組織を示す光学顕微鏡写真である。

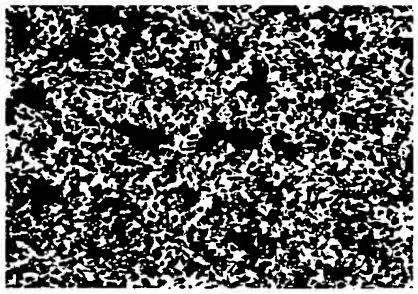
【図１】



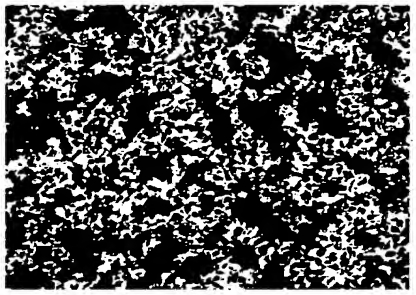
【図２】



【図３】



【図４】



フロントページの続き

Ｆターム(参考)　4G026 BA01 BB21 BC01 BC02 BF33
BF34 BF35 BF38 BF43 BF48
BG02 BG07 BG09
4J040 AA011 HA061 HA066 HA366
KA03 KA07 LA06 LA08 MA02
MA04 MB12

JAPANESE [JP,2001-122673,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] A glue constituent of two or more sorts of different-species members which consist of what mixed at least two sorts of material of the shape of a different particle in wettability with brazing solder material, and brazing solder material.
[Claim 2] A base metal of this brazing solder material is the brazing solder material which is Au, Ag, Cu, Pd, aluminum, or nickel. Moreover, a ceramic particle to which surface treatment is not performed for what mixed at least two sorts of material of the shape of a different particle in wettability with this brazing solder material, a cermet particle, or a low expansion metal particle, An adhesives constituent according to claim 1 characterized by being mixture with a ceramic particle by which surface treatment is carried out, a cermet particle, or a low expansion metal particle.
[Claim 3] An adhesives constituent according to claim 2 with which what mixed at least two sorts of material of the shape of a different particle in wettability with this brazing solder material is characterized by being that in which particle-like material with which surface treatment is not performed, and particle-like material by which surface treatment is carried out are contained with a mixing ratio of 80:20-5:95.
[Claim 4] A member which has a crevice which constitutes fitting structure, and a member which is a member which has heights which constitute fitting structure, and has a crevice face [making it fit in and joining] a member of a class which is different from each other. After covering at homogeneity the crevice surface of a member which has a crevice with what mixed at least two sorts of material of the shape of a different particle in wettability with brazing solder material Brazing solder material, such as the shape of tabular or fine particles, is arranged so that a part of layer [at least] which consists of material of the shape of this particle may be covered. On furthermore, the crevice surface of a member which arranges a member which has heights or has a crevice So that homogeneity may be covered with what mixed at least two sorts of material of the shape of a different particle in wettability with brazing solder material and material of the shape of a different particle in wettability with this brazing solder material may be stuck to a layer which consists of what was mixed at least two sorts [whether a member which has heights by which brazing solder material was inserted in a hole where 1 or plurality was punched is arranged, and] Or a member which has heights in which a layer which consists of what mixed at least two sorts of material of the shape of a particle which is different in the wettability of brazing solder material and brazing solder material in a point beforehand was formed is prepared. A production process which

arranges a member which has heights which have arranged brazing solder material upwards on the crevice surface of a member which has a crevice, and have the layer concerned, Warm what was prepared in this way to a temperature predetermined in the bottom of pressurization, and this brazing solder material is fused. How to manufacture a compound member which consists of different-species members which consist of a production process which is made to carry out impregnation to what mixed at least two sorts of material of the shape of a different particle in wettability with brazing solder material, forms this brazing solder material and a junctional zone, and joins different-species members through fitting structure.
[Claim 5] After covering homogeneity with what mixed at least two sorts of particle-like material with which production processes which arrange a member which has the above-mentioned heights differ in wettability with brazing solder material on the crevice surface of a member which has a crevice A method according to claim 4 of consisting of arranging brazing solder material, such as the shape of tabular or fine particles, so that a part of layer [at least] which consists of what mixed at least two sorts of material of the shape of a different particle in wettability with this brazing solder material may be covered, and arranging a member which has heights further.
[Claim 6] Homogeneity is covered with what mixed at least two sorts of particle-like material with which production processes which arrange a member which has the above-mentioned heights differ in wettability with brazing solder material on the crevice surface of a member which has a crevice. A method according to claim 4 of consisting of a thing which arrange a member which has heights by which brazing solder material was inserted in a hole where 1 or plurality was punched so that material of the shape of a different particle in wettability with this brazing solder material might be stuck to a layer which consists of what was mixed at least two sorts and to arrange.
[Claim 7] The method according to claim 4 of consisting of arranging a member which has heights which a production process which arranges a member which has the above-mentioned heights prepares for a point beforehand a member which has heights in_which a layer which consists of what mixed at least two sorts of material of the shape of a different particle in brazing-solder material and wettability was formed, have arranged brazing-solder material upwards on the crevice surface of a member which has a crevice, and have the layer concerned.
[Claim 8] A method given in claim 4 characterized by at least one side of this different-species member being a member made from a ceramic thru/or any 1 term of 7.
[Claim 9] A method given in claim 4 to which one side of this different-species member is characterized by another side being a metal member by member made from a ceramic thru/or any 1 term of 8.
[Claim 10] A method given in claim 4 characterized by being the material of the shape of a particle to which this particle reduces thermal stress thru/or any 1 term of 9.
[Claim 11] A base metal of this brazing solder material is the brazing solder material which is Au, Ag, Cu, Pd, aluminum, or nickel. A ceramic particle to which surface treatment is not performed for what mixed at least two sorts of material of the shape of a different particle in wettability with this this brazing solder material, A method given in claim 4 characterized by being mixture with a cermet particle or a low expansion metal particle, a ceramic particle to which surface treatment is performed and a cermet particle, or a low expansion metal particle thru/or any 1 term of 10.
[Claim 12] A method given in claim 4 characterized by a ceramic particle to which this surface

treatment is performed, a cermet particle, or a low expansion metal particle being a particle covered by plating or spatter by metal thru/or any 1 term of 11.

[Claim 13] It is the compound member joined by junctional zone which consists of what mixed at least two sorts of material of the shape of a particle which it is a member which has a crevice which constitutes fitting structure, and the member which has heights which constitute fitting structure, and consists of a member of a different kind to a member which has a crevice, and the above-mentioned different-species member fits in mutually, and is different in wettability with brazing solder material, and brazing solder material.

[Claim 14] this -- a compound member according to claim 13 whose at least one of two or more sorts of the different-species members is a member made from a ceramic.

[Claim 15] this -- a compound member according to claim 13 or 14 two or more sorts of whose different-species members are the combination of a metal member and a member made from a ceramic.

[Claim 16] A compound member according to claim 15 characterized by being the material of the shape of a particle to which this particle reduces thermal stress.

[Claim 17] A base metal of this brazing solder material is the brazing solder material which is Au, Ag, Cu, Pd, aluminum, or nickel. A ceramic particle to which surface treatment is not performed for what mixed at least two sorts of material of the shape of a different particle in wettability with this brazing solder material, a cermet particle, or a low expansion metal particle, A compound member given in claim 13 characterized by being mixture with a ceramic particle by which surface treatment is carried out, a cermet particle, or a low expansion metal particle thru/or any 1 term of 16.

[Claim 18] A compound member given in claim 13 characterized by this ceramic particle by which surface treatment is carried out, a cermet particle, or a low expansion metal particle being a particle covered by plating or spatter by metal thru/or any 1 term of 17.

[Translation done.]

JAPANESE [JP,2001-122673,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the compound member joined by the cementation method using a glue constituent and this constituent and this cementation method of the different-species member which consists of two or more sorts joined through fitting structure. Furthermore, it is the glue constituent of the compound member which consists of two or more sorts of different members in detail, and is related with the compound member joined by the method of joining two or more sorts of different-species members using the adhesives constituent and this constituent by which the expansion coefficient and residual stress for joining different-species members through fitting structure were controlled, and this method.
[0002]
[Description of the Prior Art] Although the method of using wax material is in cementation of a different-species member, for example, cementation to the member made from a ceramic, and a metal member The thermal stress resulting from the difference of the coefficient of thermal expansion of the wax material and member which were used during the cooling actuation after the cementation in an elevated temperature in order to join these different-species member between different-species members occurs. Exfoliation can be produced in a cementation interface, and when one member is brittle, a crack is produced near the cementation interface, and neither desired bonding strength nor airtightness can be acquired. Since the product which these abnormalities generated in the manufacture process must be disposed of as a defective, it serves as a cause which pushes up the cost of the product of these compound member. Moreover, in costing a heat cycle at the time of use, these abnormalities occur after use of a fixed period, and also serve as a cause to which the reliability of a product is reduced.
[0003] After plating the surface of the plane of composition of the member made from a ceramic with a metal, for example, metals, such as nickel, in order to secure **** of the member made from a ceramic, and wax material in joining a different-species member using wax material, both members are set, and a suitable gap is opposed and is arranged, wax material is slushed into this gap and the method to which it is made to join is usually adopted. Moreover, even if there is no metal plating processing, there is also the technique of adding additives, such as Ti which can secure **** by forming reaction layers, such as a nitride and an oxide, in the ceramic surface, into wax material. However, these methods are not enough to reduce thermal stress, and since a

crack is often formed in the brittle member side made from a ceramic, or exfoliation is produced in a joint to thermal stress and various engine performance, such as not only bond strength but airtightness demanded as a compound member, is affected, it is not desirable. Moreover, the method of using the elasticity metal which can ease stress as middle material is usually adopted by being rich in reactivity with the method and ceramic which are used as middle material, and deforming plastically a metal with a low coefficient of thermal expansion as a method of easing thermal stress, in the case of cementation. However, such technology is also made into the problem and the lowness of the problem resulting from the differential thermal expansion between wax material and a member, for example, a heat cycle property, etc. cannot necessarily say it as the high technology of versatility. Moreover, although there is a high-pressure solid-state-welding method as technology under current development, the present condition is that there is an unsolved technical problem in putting in practical use, therefore bond strength sufficient by this method has not come out.

[0004] On the other hand, as cored solder, use it for fixing with a semiconductor chip and a substrate, and although what mixed the powder object which consists of the quality of the material with the melting point higher than solder is indicated by JP,6-126479,A This cored solder by making only the center section of the solder main part fill up with the powder object which consists of the quality of the material with the melting point higher than solder Although it aims at canceling poor solder **** resulting from the powder object which exists also in the surface which the conventional cored solder has, and making the bonding strength in a cementation interface increase if it puts in another way However, this cored solder is not effective in the fall of thermal stress, therefore effective in solving the problem resulting from the thermal stress between the members joined or between a member and wax material.

[0005] this invention person etc. found out the fall phenomenon of the bonding strength near the cementation interface by the thermal stress between the cooling actuation after the cementation in an elevated temperature, and the glue constituent between two or more sorts of different-species members which is not made to generate a crack during the cooling actuation by the weak member to thermal stress, holding moderate bond strength for different-species members variously as a result of examination, in order to attain the above-mentioned purpose. About the concrete contents, it has applied as Japanese Patent Application No. No. 52971 [ten to] on February 18, Heisei 10.

[0006] Namely, the thing for which there is little constraint by a class, a configuration, etc. of joint material, and a cementation configuration also uses brazing solder material with much room of selection as the base as a result of examining many things in view of the above present condition, By adding the material of the shape of a particle which reduces thermal stress to this brazing solder material The fall phenomenon of the bonding strength near the cementation interface by the thermal stress between the cooling actuation after the cementation in an elevated temperature does not raise different-species members, either, holding moderate bond strength. Moreover, crack initiation is not carried out during the cooling actuation by the weak member to thermal stress, and it finds out that cementation between two or more sorts of different-species members can be attained, and results in the above-mentioned patent application.

[0007] Keep sufficient gap to join mutually two or more sorts of different-species members which

differ in the thermal stress as a method of joining using the above-mentioned constituent, and it is made to arrange face to face mutually. Slush the above-mentioned constituent into this gap, or it is filled up with the ceramic or cermet particle of the specified quantity. the brazing solder material of the specified quantity succeedingly changed into the melting condition -- slushing -- subsequently -- cooling -- this, although the method of joining two or more sorts of different-species members, and manufacturing a compound member is indicated in the above-mentioned patent application If it remains as it is, it cannot be used for cementation of the members which do not have sufficient gap which can slush the brazing solder material of the specified quantity.

[0008] When the different-species member which consists of two or more sorts which must be joined through fitting structure is joined, and an about 0.01-0.30mm very narrow thing tends to be chosen and it is going to join both members as path clearance especially, unless it also fills up the side of a member with wax material equally generally as much as possible, it is not rare for various un-arranging to arise. On the other hand, when this path clearance is larger than the above-mentioned maximum, a crack may occur with the residual stress which is generated by not filling up this path clearance with wax material equally at the time of melting of wax material and by which endocyst was carried out. If this is explained more concretely, in case the member which has a cylinder-like crevice, and the member which has cylinder-like heights will be fitted in, for example Since there is a certain amount of [the wax material with which the path clearance of the shape of a cylinder formed from both members should be filled up equally / this path clearance] additional coverage When inclined only toward one side by some causes, the balance of the heat shrink stress in the process which cools wax material and is made to solidify collapses, the member which has cylinder-like heights is pulled by the one direction, as a result, residual stress arises, and a crack may be generated. Furthermore, there are also a request on the dimensional accuracy of the compound member as a finished product and a request on a fine sight. Therefore, by slushing the brazing solder material of the specified quantity into the members which have only the close clearance parts above in this way from this close clearance part, since things were substantially impossible, these different-species members were unjoinable by the above-mentioned method. In addition, path clearance means the width of face of the crevice which exists between the wall surfaces of these different-species members in a part for the fitting structured division here.

[0009] Then, the member which has the crevice which constitutes fitting structure in order that this invention person etc. may solve this technical problem, the member which is a member which has the heights which constitute fitting structure, and has a crevice -- difference -- it facing making the member of a class fit in and joining it, and, after covering with particle-like material at homogeneity the crevice surface of the member which has a crevice Arrange brazing solder material, such as the shape of tabular or fine particles, so that a part of layer [at least] which consists of material of the shape of this particle may be covered, and the member which has heights further is arranged. Warm to a temperature predetermined in the bottom of pressurization, fuse brazing solder material, and this fused brazing solder material is made to permeate into the layer which consists of material of the shape of this particle. The member which has the crevice which forms the junctional zone by the adhesives constituent by which the expansion coefficient which consists of material of the shape of this brazing solder material and a particle was controlled, or constitutes

fitting structure, Are the member which has the heights which constitute fitting structure, and it faces making the member of the class which is different from each other fit in, and joining to the member which has a crevice. So that the crevice surface of the member which has a crevice may be covered with particle-like material at homogeneity and it may stick to the layer which consists of material of the shape of this particle The member which has the heights by which brazing solder material was inserted in the hole where 1 or plurality was punched is arranged. Warm to a temperature predetermined in the bottom of pressurization, fuse brazing solder material, and this fused brazing solder material is made to permeate into the layer which consists of material of the shape of this particle. [whether the junctional zone by the adhesives constituent by which the expansion coefficient which consists of material of the shape of this brazing solder material and a particle was controlled is formed, and] The member which has the heights in which the layer which becomes a point from the material of the shape of brazing solder material and a particle beforehand was formed is prepared. Arrange the member which has the heights in which the layer which has arranged only brazing solder material upwards on the crevice surface of the member which has a crevice, and consists of material of the shape of brazing solder material and a particle concerned was formed, and it warms to a predetermined temperature under pressurization. The layer which consists of material of the shape of the brazing solder material formed at the tip of the member which has these heights, and a particle, By fusing the brazing solder material arranged on the crevice surface of the member which has a crevice, and forming the junctional zone which consists of an adhesives constituent by which the expansion coefficient which consists of material of the shape of brazing solder material and a particle was controlled It found out that different-species members were joinable through fitting structure, and has applied as Japanese Patent Application No. No. 180902 [11 to] on June 25, Heisei 11 based on the knowledge.

[0010] Moreover, it sets on the Japanese-Patent-Application-No. No. 180902 [11 to] specifications for which it applied on June 25, Heisei 11. The member which has the crevice which constitutes the fitting structure which fitted in in this way and was joined, Are the member which has the heights which constitute fitting structure, and it becomes the member which has a crevice from the member of the class which is different from each other at least. The above-mentioned different-species members fitted in mutually, and it has proposed to coincidence also about the compound member which has the improved heat cycle property which consists of two or more sorts of different-species members characterized by being joined with the adhesives constituent by which the expansion coefficient which consists of particle-like material and brazing solder material was controlled.

[0011] However, in order to secure **** with brazing solder material, nickel plating is performed to the distributed material distributed in brazing solder material. Although an expansion coefficient is reduced as compared with metallic material slack brazing solder material and the complex slack wax material layer formed by this technique is effective in failure suppression of a transconjugant slack ceramic etc., or the heat cycle property improvement of a joint A case [the reinforcement of a transconjugant slack ceramic is low] (in for example, the cases of alumimium nitride etc.) It was difficult to control failure completely, and when joint-ed area became large, further, the danger of the failure generating increased, and when there was much joint order in 1 product, it encountered the problem that the percent defective of a product was hard to be disregarded. Although

reduction of Young's modulus, reduction of a proof stress value, etc. were [other than expansion coefficient reduction of wax material] effective in failure suppression of a transconjugant, it became clear only by the above-mentioned technique that it is difficult to operate all these physical properties advantageously positively.

[0012]

[Problem(s) to be Solved by the Invention] The technical problem which this invention tends to solve Therefore, property control of the above-mentioned compound wax material, To expansion coefficient reduction, namely, in addition, the glue constituent of two or more sorts of different-species members which can obtain the zygote which was excellent in the heat-resistant property etc., inhibiting failure of a transconjugant by performing reduction of Young's modulus, and reduction of a proof stress value, It is in offering the compound member which consists of two or more sorts of different-species members joined by the cementation method of two or more sorts of different-species members which used this binder, and this method.

[0013]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, variously, as a result of examination, this invention person etc. finds out that the purpose of the above [a glue constituent of two or more sorts of different-species members which consist of what mixed at least two sorts of material of the shape of a different particle in wettability with brazing solder material, and brazing solder material] can be attained, and completes the invention in this application.

[0014] Moreover, by using an adhesives constituent with which an expansion coefficient, Young's modulus, and a proof stress value were controlled by the above-mentioned technique, it finds out that a zygote of a compound member which consists of different-species members which joined the different-species members which failure was inhibited and were excellent in a heat-resistant property etc. through fitting structure can be manufactured, and the 2nd side of this invention is completed. Furthermore, by using an adhesives constituent by which an expansion coefficient, above-mentioned Young's modulus, and an above-mentioned proof stress value were controlled Are a member which has a crevice which constitutes fitting structure, and the member which has heights which constitute fitting structure, and it consists of a member of a different kind to a member which has a crevice. A compound member excellent in a heat-resistant property joined by junctional zone which consists of what mixed at least two sorts of material of the shape of a particle which the above-mentioned different-species member fits in mutually, and is different in wettability with brazing solder material, and brazing solder material It finds out being obtained without occurring failure and the 3rd side of this invention is completed.

[0015]

[Embodiment of the Invention] The 1st side of this invention is related with the glue constituent of two or more sorts of different-species members which consist of what mixed at least two sorts of material of the shape of a different particle in wettability with brazing solder material, and brazing solder material. In this binder constituent, the base metal which constitutes brazing solder material As what mixed at least two sorts of material of the shape of a particle which is Au, Ag, Cu, Pd, aluminum, or nickel, and is different in wettability with this brazing solder material It is desirable that it is the mixture of the ceramic particle to which surface treatment is not performed, a cermet

particle or a low expansion metal particle, and the ceramic particle to which surface treatment is performed, a cermet particle or a low expansion metal particle. That whose mixing ratios of the particle-like material with which surface treatment is not performed, and the material of the shape of a particle by which surface treatment is carried out are 5:95-80:20 as what mixed at least two sorts of material of the shape of a different particle in wettability with brazing solder material is desirable. Different material in wettability with brazing solder material says the combination of what more excellent and a more inferior thing in relative wettability with brazing solder material. [0016] in relative wettability with brazing solder material, surface treatment, such as a ceramic particle which performed surface treatment, such as plating, a ceramic particle to which surface treatment is not performed, and plating, was performed as an example of the combination of what more excellent and a more inferior thing -- it is -- it is -- there are a low expansion metal particle which is not given, a ceramic particle to which surface treatment is not performed. Although there is especially no limit as the plating method in these, electroless deposition is used suitably. Moreover, even if there is no metal plating processing, **** with brazing solder is securable by forming the reaction layer of activity material, such as a nitride, an oxide, and carbide, in the ceramic surface by mixing additives, such as Ti, as a particle in wax material or particle-like material. In this case, if what has a difference in wettability with the brazing solder material containing this additive is combined, it is possible to do the aforementioned effect so. For example, the effect can be suitably acquired by using the combination of distributed material as a nitride, an oxide or a nitride, and carbide. About 0.5 - 5% of the addition of this activity material in these cases is suitable to brazing solder material at a weight ratio. Namely, the material of the shape of a particle which consists of what mixed at least two sorts of different material in wettability with brazing solder material For example, a desired grain size to which nickel plating of about 0.5 micrometers was performed as a particle by which surface treatment was performed to desired thickness, for example, the alumina particle which is the mean particle diameter of 50 micrometers, As a particle to which surface treatment is not performed, it can prepare easily by mixing a desired grain size, for example, an alumina particle with a mean particle diameter of 50 micrometers. Or the material of the shape of a particle which consists of what mixed at least two sorts of material which is different in wettability with constant-rate **** brazing solder material in the add-in-material slack Ti etc. can be easily prepared by mixing a desired grain size, for example, an alumina particle with a mean particle diameter of 50 micrometers, with a desired grain size, for example, nitriding aluminum with a mean particle diameter of 50 micrometers. [0017] The ratio which the particle-like material with which 1:9, i.e., surface treatment, is not given more preferably occupies in [all] a particle is about 3:1, i.e., 75%, from about 10%, and the mixing ratio of the particle-like material with which surface treatment is not performed, and the material of the shape of a particle by which surface treatment is carried out is 1:3 to about 1:1 still more preferably. Since the operation effect as adhesives will fall remarkably if the mixing ratio of non-surface treatment material is raised from 3:1, it is not desirable. The brazing solder material made to permeate when obtaining the adhesives constituent concerning this invention, the method of making it permeate, conditions, etc. should just follow the publication of a Japanese-Patent-Application-No. No. 180902 [11 to] specification. Moreover, the particle-like material with which surface treatment which secures wettability is performed, and the particle-like material with which

surface treatment which secures wettability is not performed do not necessarily need to be the material of the same kind, and in order to secure wettability, they should just be the combination of the material of the shape of a particle to which surface treatment is performed, and the particle-like material with which surface treatment is not performed. If it returns, it cannot be overemphasized that it is not necessary to use the same kind with which only the existence of plating processing differs.

[0018] As brazing solder material used for the adhesion object constituent concerning this invention, the wax material which used metals, such as Au, Ag, Cu, Pd, aluminum, and nickel, as the base is mentioned. Of course, what is necessary is just to use a more suitable thing by relation with the temperature conditions for which the reactivity of the wettability of the member and wax material to join, the member to join, or a particulate material and wax material or wax material is used. The operating environment temperature of joint material is suitably used as a thing 500 degrees C or less for aluminum system wax material 4004 (aluminum-10Si-1.5Mg), for example, BA etc. The operating environment temperature of joint material is suitably used for Au, BAu-4 (Au-18nickel), BAg-8 (Ag-28Cu), etc. as a thing 500 degrees C or more.

[0019] By reducing positively in part the interface cementation force of the distributed material and brazing solder material which are distributed in brazing solder material by using the adhesives constituent concerning this invention, or making a detailed hole form positively into an adhesives constituent The effect that the zygote excellent in the heat-resistant property etc. can be obtained will be demonstrated inhibiting failure of a transconjugant by performing reduction of Young's modulus, and reduction of a proof stress value in addition to expansion coefficient reduction. It is more specifically mixing and using the particle which was excellent in wettability with brazing solder material in the distributed material distributed in brazing solder material, and the particle inferior to wettability, and this effect is attained. The particle to which surface treatment, such as plating processing which can secure wettability with brazing solder material, was carried out as combination of the particle which was excellent here at wettability with brazing solder material, and the particle inferior to wettability, the particle to which surface treatment which secures wettability, such as plating processing, is not performed or a nitride and an oxide, low expansion metal particles, an oxide, etc. are used suitably. When there are many ratios of the particle excellent in wettability with brazing solder material The structure top of the microstructure of the adhesives constituent observed optically Although there are no adhesives constituent and difference which were built only with the particle to which surface treatment was performed The reduction effect of expansion coefficient reduction equivalent to the adhesives constituent built only with the particle excellent in wettability and Young's modulus reduction not only being attained but a proof stress value is higher than the adhesives constituent built only with the particle to which surface treatment was performed. This is that the interface cementation force of the particle and brazing solder material inferior to wettability is reduced as compared with the particle excellent in wettability, and is considered that the property of an adhesives constituent was controlled.

[0020] Moreover, if the ratio of the particle which was inferior in wettability with brazing solder material is gathered, into an adhesives constituent, an observable hole will be formed optically, and, in addition to expansion coefficient reduction equivalent to the adhesives constituent built only with the particle excellent in wettability, reduction of Young's modulus and reduction of a proof

stress value will be attained more as compared with a constituent with few amounts of the particle which was inferior in wettability with brazing solder material. This is understand to be what proof stress reduces by Young's modulus decrease and become a point at the time of a load occur [crack] near [concerned] the hole part etc. as a result of the cross section over which only the constituent concerned is cover by existence of the formed hole decrease in addition to the reduction effect of the interface cementation force of ** and the distributed material which were set to the constituent with more particles which were inferior in wettability with brazing solder material , and brazing solder material . Although the operation effect was divided for convenience and the amount of a particle to which surface treatment which secures wettability, such as plating processing, is not performed explained it when explaining the device in which the effect that the adhesives constituent concerning this invention does so is made to discover, the purpose, the creation technique, and the operation effect are the same, and the need of dividing a boundary strictly is low. However, it may be needed when considering the seal nature of the joint of the adhesives constituent concerned.

[0021] In order to reduce thermal stress efficiently, it is necessary to adjust the pack density to particle-like the class and brazing solder material of material, and, for that purpose, it necessary to adjust the coefficient of thermal expansion of an adhesives constituent layer. The material of the shape of a particle to which thermal stress is reduced is so advantageous to lowering the coefficient of thermal expansion of an adhesives constituent layer that the expansion coefficient is small. It is made for the pack density to the brazing solder material of particle-like material to become 40 to 70% from 30 desirably 90% by the volume ratio by the case where only the particle excellent in wettability with brazing solder material is distributed. It is made for the volume ratio of the particle at the time of calculating as what does not have a hole into this adhesives constituent by the case where the particle inferior to the wettability of one of a particle excellent in wettability with brazing solder material and brazing solder material is distributed to become 40 to 70% from 30 desirably 90% like the above. Moreover, although it is advantageous to lowering an expansion coefficient in these cases to raise the pack density of particle-like material, since it may be accompanied by deterioration of bonding strength, it is not so desirable to make pack density high. Moreover, to be low, since the expansion coefficient considered as a request may not be reached, consideration is required. That is, adjustment of an expansion coefficient is attained by choosing so that the expansion coefficient of a request of the class of particle-like material can be attained, or choosing the particle size distribution of particle-like material suitably.

[0022] It faces the member which has the crevice which constitutes fitting structure, and the member which is a member which has the heights which constitute fitting structure, and has a crevice making the member of the class which is different from each other fit in [side / of this invention / 2nd], and joining. After covering at homogeneity the crevice surface of the member which has a crevice with what mixed at least two sorts of material of the shape of a different particle in wettability with brazing solder material Brazing solder material, such as the shape of tabular or fine particles, is arranged so that a part of layer [at least] which consists of what mixed at least two sorts of material of the shape of a different particle in wettability with this brazing solder material may be covered. Furthermore, so that homogeneity may be covered with what mixed at least two sorts of material of the shape of a different particle in wettability with brazing

solder material and it may stick to the crevice surface of the member which arranges the member which has heights or has a crevice at the layer which consists of material of the shape of this particle [whether the member which has the heights by which brazing solder material was inserted in the hole where 1 or plurality was punched is arranged, and] Or the member which has the heights in which the layer which consists of what mixed at least two sorts of material of the shape of a particle which is different in the wettability of brazing solder material and brazing solder material in a point beforehand was formed is prepared. The production process which arranges the member which has the heights which have arranged brazing solder material upwards on the crevice surface of the member which has a crevice, and have the layer concerned, Warm what was prepared in this way to a temperature predetermined in the bottom of pressurization, and this brazing solder material is fused. The junctional zone which is made to carry out impregnation to what mixed at least two sorts of material of the shape of a different particle in wettability with brazing solder material, and consists of this brazing solder material and material of the shape of this particle is formed. It is related with the method of manufacturing the compound member which consists of different-species members which consist of a production process which joins different-species members through fitting structure.

[0023] The 1st mode of the cementation method concerning the 2nd side of this invention After covering homogeneity with what mixed at least two sorts of material of the shape of a particle which is different in wettability with brazing solder material on the crevice surface of the member (1) which has a crevice (4) Brazing solder material (3), such as the shape of tabular or fine particles, is arranged so that a part of layer [at least] which consists of what mixed at least two sorts of material of the shape of a different particle in wettability with this brazing solder material may be covered. Furthermore, arrange the member (2) which has heights, warm to a temperature predetermined in the bottom of pressurization, and melting of the brazing solder material is carried out. It is the method of joining different-species members through fitting structure by forming the junctional zone by the adhesion constituent which the brazing solder material which carried out melting is made to permeate the material of the shape of this particle, and consists of material of the shape of this brazing solder material and a particle. Under the present circumstances, you may use it instead of the brazing solder material of the shape of tabular [which covers the layer and this layer which consist of material of the shape of this particle what mixed fine-particles-like brazing solder material with the material of the shape of this particle], or fine particles. Moreover, so that the 2nd mode may cover homogeneity with what mixed at least two sorts of material of the shape of a particle which is different in wettability with brazing solder material on the crevice surface of the member (1) which has a crevice (4) and it may stick to the layer which consists of material of the shape of this particle The member (2) which has the heights by which brazing solder material (3) was inserted in the hole where 1 or plurality was punched is arranged. By warming to a temperature predetermined in the bottom of pressurization, and making what mixed at least two sorts of material of the shape of a particle which is different in wettability with this brazing solder material in the brazing solder material to which melting of the brazing solder material was carried out, and it carried out melting permeate It is the method of joining different-species members through fitting structure by forming the junctional zone by the adhesion constituent which consists of material of the shape of this brazing solder material and a particle.

Moreover, the 3rd mode prepares the member (2) which has the heights in which the layer (5) which consists of what mixed at least two sorts of material of the shape of a particle which is different in the wettability of brazing solder material and brazing solder material in a point beforehand was formed. The member which has the heights which have arranged brazing solder material (6) upwards on the crevice surface of the member (1) which has a crevice, and have the layer concerned is arranged. The layer which consists of what mixed at least two sorts of material of the shape of a different particle in the wettability of the brazing solder material and brazing solder material which were formed at the tip of the member which warms to a temperature predetermined in the bottom of pressurization, and has these heights, It is the method of joining different-species members through fitting structure by forming the junctional zone which fuses the brazing solder material arranged on the crevice surface of the member which has a crevice, and consists of material of the shape of brazing solder material and a particle.

[0024] In addition, the melting conditions containing the conditions adopted on the occasion of cementation in addition to the above, for example, the configuration method of various materials, melting temperature, etc., cooling conditions, etc. should just follow at a publication the Japanese-Patent-Application-No. No. 180902 [11 to] specification for which it applied to the Japanese Patent Application No. No. 52971 [ten to] and June 25, Heisei 11 concerning the application on February 18, Heisei 10. Therefore, the contents of the Japanese-Patent-Application-No. No. 180902 [11 to] specification for which it applied to the Japanese Patent Application No. No. 52971 [ten to] and June 25, Heisei 11 concerning the application on February 18, Heisei 10 are quoted by reference here.

[0025] As combination of two or more sorts of different-species members used in this invention, the combination of members made from a different-species ceramic, such as making the combination or the manufacture raw material of members made from the ceramics, such as alumimium nitride and silicon nitride, and metal members, such as molybdenum, and covar, a tungsten, into things, for example, is mentioned. The alumimium nitride member which is more specifically used in semiconductor wafer manufacture and which demonstrates an electrostatic chuck function and a heater function with the metal-electrode metallurgy group heating element to build in, the compound member which consists of a thing which is joined as a terminal which supplies electric power to the metal-electrode material concerned built in, and which a metal molybdenum member is made to fit in for example, and join are mentioned.

[0026] The member which has the crevice which constitutes the fitting structure which is the 3rd side of this invention, It is the member which has the heights which constitute fitting structure, and becomes the member which has a crevice from the member of the class which is different from each other, and the above-mentioned different-species member fits in mutually. Fundamentally The compound member which is joined by the junctional zone which consists of an adhesives constituent which consists of the material and the brazing solder material of the shape of a particle which consists of what mixed at least two sorts of different material in wettability with brazing solder material and which consists of two or more sorts of different-species members can be manufactured by the above-mentioned method. the wall surface of the member which has a crevice, and the member which has this crevice -- difference -- the path clearance between the wall surfaces of the different-species member in the fitting structured division formed between wall

surfaces with the member which has the heights which consist of a member of a class is usually good preferably to be referred to as about 0.02-0.07mm about 0.01-0.3mm. It is [a possibility that un-arranging / which was mentioned above / with which wax material inclines and is filled up like / may arise] and is not desirable, if there is a possibility that it cannot fit in in members if it deviates from the above-mentioned minimum and it deviates from the above-mentioned maximum.

[0027]

[Example] Although an example is given below and this invention is explained, of course, it cannot be overemphasized that this invention is not what is restricted in any way by these examples. Evaluation of a cementation condition and a heat-resistant cycle property was judged by whether deterioration of the tensile strength of a joint before and after exposing to a heat-resistant cycle ambient atmosphere has taken place. Under the present circumstances, it was judged that what caused 25% or more of deterioration on the strength to exposure before was poor. Moreover, it investigated whether neither a base material crack nor exfoliation would have arisen in the joint by junctional-zone cross-section observation for reference.

[0028] An alumina with a mean particle diameter of 50 micrometers which performed nickel plating processing with a thickness of about 0.3 micrometers to the particle surface, (Example 1) What mixed the alumina with a mean particle diameter of 50 micrometers which does not perform surface treatment by the ratio of 1:0, 3:1, 2:1, 1.5:1, and 1:1 and 1:3, respectively is made into a particulate material. After making the brazing solder material A5005 (aluminum-0.8Mg) permeate the particulate material concerned under fixed pressurization, the machine physical property measured with the sample prepared from the adhesives constituent made to solidify is shown in a table 1. Moreover, the optical microscope photograph of the microstructure of the typical thing of them is shown in drawing 2 thru/or 4. In addition, although drawing 1 used the material of the shape of a particle which consists only of an alumina with a mean particle diameter of 50 micrometers which performed nickel plating processing which is an example of a comparison, it is an optical microscope photograph in which a microstructure is shown.

[0029]

[A table 1]

接着剤組成物の機械物理特性

ﾒｯｷ厚さ（μm）	ﾒｯｷ処理粒の混合率(%)	膨張係数（×10⁻⁶）	ﾔﾝｸﾞ率 (GPa)	比例限 (MPa)	備考
0.3	100	13.4	103	70	
0.3	75	13.5	101	65	
0.3	67	13.2	95	63	
0.3	60	13.1	75	52	
0.3	50	13.5	57	45	
0.3	25	−	−	−	安定接合に難あり

[0030] An alumina with a mean particle diameter of 50 micrometers which performed about 1-micrometer nickel plating processing to the particle surface, (Example 2) What mixed the alumina with a mean particle diameter of 50 micrometers which does not perform surface treatment by the ratio of 1:0, 3:1, 2:1, 1.5:1, and 1:1 and 1:3, respectively is made into a particulate material. The machine physical property measured with the sample prepared from the adhesives constituent made to solidify after making the brazing solder material A5005 (aluminum-0.8Mg) permeate the

particulate material concerned under fixed pressurization is shown in a table 2.

[0031]

[A table 2]

接着剤組成物の機械物理特性

メッキ厚さ（μm）	メッキ処理粒の混合率（%）	膨張係数（×10⁻⁶）	ヤング率（GPa）	比例限（MPa）	備考
1.0	100	13.1	135	103	
1.0	75	13.5	129	91	
1.0	67	12.8	102	83	
1.0	60	13.3	90	62	
1.0	50	12.2	70	47	
1.0	25	13.0	59	25	

[0032] The alumimium nitride member the depth of whose the diameter of the hole of the slitting structured division for checking and verifying where the thickness of a member was punched at right angles to 10.0mm and a member as a member which has the crevice which constitutes fitting structure is 5.07mm, and is 9.5mm, (Example 3) the member which is a member which has the heights which constitute fitting structure, and has a crevice -- difference -- it joined on condition that the following as a member of a class using the member made from metal molybdenum of the shape of a cylinder with a diameter [of 5.0mm], and a length of 15.0mm.

[0033] The crevice surface on which about 0.5-micrometer nickel plating processing of the member made from alumimium nitride which is a member in which it had a crevice was performed was covered with what mixed the alumina with a mean particle diameter of 50 micrometers which performed nickel plating processing with a thickness of about 0.3 micrometers to the particle surface, and the alumina with a mean particle diameter of 50 micrometers which does not perform surface treatment by the ratio of 1:0, 2:1, and 1:1, respectively as a particulate material at homogeneity, respectively. The thickness of the layer of the particulate material concerned with which it was covered was 0.8mm, respectively. The brazing solder material A5005 (aluminum-0.8Mg) arranged so that this particulate material may be covered permeated into the layer which fuses during heating and consists of particle-like material, and formed the compound glue line. One kind of sample which consists the sample joined by the compound glue line which consists of what mixed two or more sorts of material of the shape of a different particle at least in wettability with brazing solder material in this way, and brazing solder material of the material and the brazing solder material of the shape of a particle which becomes two kinds only from an alumina with a mean particle diameter of 50 micrometers which performed nickel plating processing as an example of a comparison and which was joined by the compound glue line was prepared. The thickness of the formed compound glue line was 0.8mm, respectively.

[0034] In this way, the thermal cycling test was presented with the obtained joint material. Thermal cycling test conditions carried out the temperature up of this joint material from 60 degrees C to 180 degrees C by the programming rate of 2.5 degrees C / min, lowered it immediately after attainment to 180 degrees C to 60 degrees C by -2.5 degrees C in temperature fall speed / min, and repeated after attainment processing in which the same cycle was repeated immediately again, 50 times to 60 degrees C. The crack generating condition of the nitriding aluminum after a thermal cycling test is shown in a table 3. Moreover, the bonding strength test result of the molybdenum terminal before and behind a thermal cycling test and nitriding aluminum is shown in

a table 4.

[0035]

[A table 3]

被接合体の破損抑止効果

メッキ処理粒の混合率（%）	膨張係数（×10⁻⁶）	ヤング率（GPa）	比例限（MPa）	破損抑止効果（破損数／サンプル数）
100	13.1	135	103	4／18
67	12.8	102	83	1／19
50	12.2	70	47	0／35

[0036]

[A table 4]

被接合体の接合強度

実施例、比較例の別	メッキ処理粒の混合率（%）	接合上がり強度（MPa）	熱サイクル試験後の強度（MPa）	熱サイクル試験前後の強度の比（%）
比較例 1	100	4723	4969	103
比較例 2	100	5069	4794	100
比較例 3	100	4639	4549	95
実施例1－1	67	4768	4490	94
実施例1－2	67	4330	4930	101
実施例1－3	67	4530	4750	100
実施例2－1	50	4930	4380	92
実施例2－2	50	4944	5120	110
実施例2－3	50	4730	4530	97

＊ 熱サイクル試験前後の強度の比（%）は比較例、実施例1、実施例2とも接合上がり強度（MPa）（n＝8）の平均値に対する熱サイクル試験後の強度（MPa）として示した。

[0037] The glue constituent concerning this invention so that clearly from the microphotography of the microstructure attached as the test result shown in the above-mentioned table 1 and drawing 2 thru/or 4 Since a part of cementation force of distributed material and brazing solder material is controlled or a detailed hole is introduced all over a microstructure, as a result of the part by which this cementation force was controlled, or the introduced this hole working as a destructive origin, also when thermal stress isodynamia is added, as shown in the above-mentioned table 3, failure can be avoided effectively. In addition, although reduction of Young's modulus and reduction of a proof stress value are accepted in the case of the glue constituent applied to this invention as shown in a table 1, coefficient of thermal expansion is are same as substantially as what used only the material of the shape of a particle which performed plating processing, and that it is same to the reinforcement of the cementation riser of a zygote and thermal resistance is the point which should be noted as shown in a table 4.

[0038]

[Effect of the Invention] using the glue constituent concerning the invention in this application -- alumimium nitride etc. -- like -- a transconjugant -- property control of compound wax material, i.e., expansion coefficient reduction, of the above even when the reinforcement of a ceramic is low -- in addition, the zygote excellent in the heat-resistant property etc. can be obtained by performing

reduction of Young's modulus, and reduction of a proof stress value, inhibiting failure of a transconjugant. Moreover, according to the cementation method which used the glue constituent concerning such the invention in this application, the failure thru/or cementation fault which may be generated in the member concerned can be made to be able to avoid by reducing the stress which remains between the members to paste up, and the compound member which consists of reliable different-species members can be manufactured. The effect that the compound member which consists of reliable different-species members in this way can be offered is demonstrated.

[Translation done.]

JAPANESE [JP,2001-122673,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the optical microscope photograph in which the microstructure of the adhesives which used only the material of the shape of a particle which performed plating processing is shown.
[Drawing 2] It is the optical microscope photograph in which the microstructure of the adhesives which used the material of the shape of a particle which has not performed plating processing, and the material of the shape of a particle which performed plating processing at a rate of 1:3 is shown.
[Drawing 3] It is the optical microscope photograph in which the microstructure of the adhesives which used the material of the shape of a particle which has not performed plating processing, and the material of the shape of a particle which performed plating processing at a rate of 1:2 is shown.
[Drawing 4] It is the optical microscope photograph in which the microstructure of the adhesives which used the material of the shape of a particle which has not performed plating processing, and the material of the shape of a particle which performed plating processing at a rate of 1:1 is shown.

[Translation done.]